

# DIVISION OF FOREST PEST CONTROL



## *Northeastern Area State & Private Forestry*

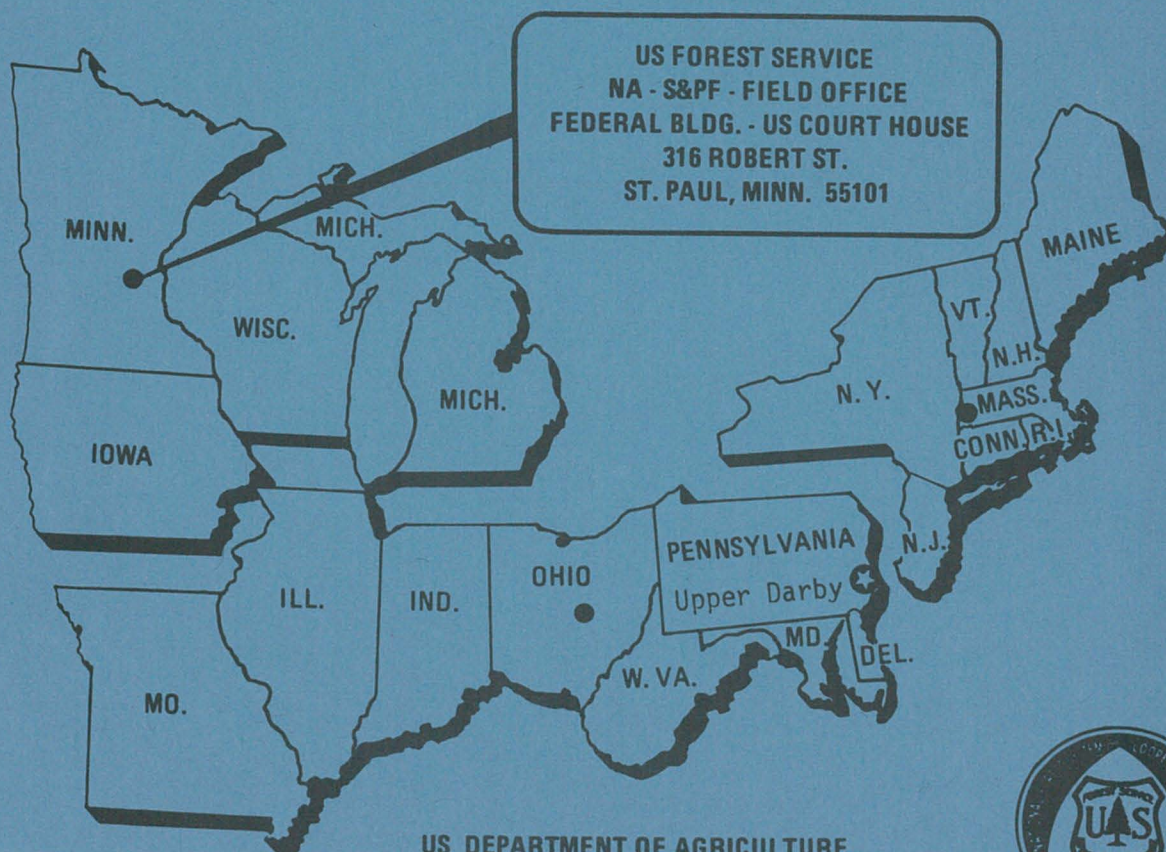
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### MALATHION CONTROLS REDHEADED PINE SAWFLY

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MALATHION CONTROLS REDHEADED PINE SAWFLY<sup>1/2/</sup>

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ABSTRACT

Aerial and ground applications of malathion reduced populations of redheaded pine sawfly, Neodiprion lecontei (Fitch) on red pine, Pinus resinosa Ait., in pilot studies conducted in 1970. An aerial treatment of Malathion 95% LV Concentrate at the rate of 10 fluid ounces per acre reduced the population to zero. A mist-blower treatment at the rate of 1/2 pound actual malathion (Cythion) per acre reduced the population 96% (range 84% to 100%). In the latter test, screening by neighboring trees probably caused incomplete coverage by the spray.

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- <sup>1/</sup> Mention of companies or their products does not necessarily imply endorsement of these companies or products by the USDA.
- <sup>2/</sup> This report deals with research involving a pesticide. It contains recommendations for its use and registration but the uses as discussed here are not currently registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.
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## INTRODUCTION

The redheaded pine sawfly, Neodiprion lecontei (Fitch), is one of the most important native defoliators of young hard pines in eastern North America (Benjamin, 1955). MacAloney and Wilson (1964) reported that host trees less than 15 feet tall are most susceptible to attack. In the Lake States, Jack pine, Pinus banksiana Lamb., and red pine, P. resinosa Ait., are most heavily attacked. Other native and exotic hard pine such as Scotch pine, P. sylvestris L., mugo pine, P. mugo Turra, and ponderosa Laws., may also be attacked.

Sawfly larvae feed gregariously in colonies completely defoliating individual branches to entire trees. Partial tree defoliation results in reduced height growth (MacAloney and Wilson, 1964) and branch mortality (Schaffner, 1951). Complete tree defoliation usually kills the tree (Benjamin, 1955; MacAloney and Wilson, 1964; Schaffner, 1951).

Currently no insecticide treatment is registered by the Environmental Protection Agency for redheaded pine sawfly control. In the past, control has been

achieved with aerial and ground applications of DDT, BHC, and lindane (MacAloney, 1957). These materials are not currently registered for sawfly control.

Malathion, a short residue insecticide, is effective against some species of sawflies. For example, Wallner (1968) and Lyons (1964) recommend 95% technical and dilute applications respectively for the European pine sawfly, Neodiprion sertifer (Geoff.).

This pilot study was designed to determine the efficacy of operational aerial and mist-blower applications of malathion against the redheaded pine sawfly.

## MATERIALS AND METHODS

### Aerial application

A 45 acre red pine plantation on the Cadillac Ranger District, Manistee National Forest, in Lower Michigan, was used as the treatment area. The unsprayed plantation was 15 acres in size and located 4 air miles from the spray area. The trees in both areas were 2 to 6 ft. tall.

Insecticide--Approximately 10 fluid ounces of Malathion 95% LV<sup>1/</sup> Concentrate was applied per acre. A fixed-wing aircraft was flown at an air speed of 90 mph and at the appropriate altitude to give a 100 ft. swath width. The spray system was equipped with eight 80015 flat-fan spray nozzles set 30° down into the air stream and operated at 50 psi tank pressure.

The insecticide was applied on July 21, 1970, beginning at 6:30 AM and completed about 20 minutes later. The skies were clear, winds calm, and temperature in the low 50's F. Little moisture from dew or

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<sup>1/</sup> Trademark of American Cyanamid Company

previous rains was evident on the tree foliage.

Sampling design--The treatment area was divided into 100 rectangular blocks, 10 on each side, with corners of each block marked with flagging. In each block an infested tree was selected at random and examined for quantity of remaining foliage. If the remaining foliage would not sustain the colony through the study period, the closest infested tree with enough foliage was selected and flagged. When more than one sawfly colony was found on the selected tree, the first colony observed was marked as the sample colony and all others were destroyed. When no infested pine was found in a block, an infested tree and colony was chosen at random in an adjacent block (in addition to the regular tree).

In the check area all infested trees were numbered (about 265) and one hundred trees were selected at random to sample for natural mortality. As above, a sufficient amount of remaining foliage was ensured before final selection of the sample colony was made. Only one colony was marked, all other colonies were destroyed.

#### Mist-blower application

A 75 acre red pine roadside planting with 1 to 5 ft. tall trees was selected for the mist-blower

on the Bessemer Ranger District, Ottawa National Forest, in Upper Michigan.

Insecticide--Cythion (premium grade malathion) 57% emulsifiable liquid (5 lb per gal) was mixed as 1 quart insecticide concentrate and 19 quarts of water to make 5 gallons of solution. The spray was applied at the rate of two gallons per acre. The mist-blower was adjusted to deliver 2 gallons per 7.5 minutes. At a walking speed of 2 mph and a one-half chain (33 ft) swath width, delivery was at the rate of approximately 1/2 lb malathion per acre.

The treatment was made on July 30, 1970, beginning at 8:00 AM and completed about 8:45 AM. The skies were clear, winds about 1 mph, and temperatures in the 60's F. No moisture from dew or rain was evident on the needles.

Sampling design--Insecticide was applied to five 1/10 acre blocks. The five unsprayed 1/10 acre blocks were upwind and across the road. In each block, 20 infested trees were selected and tagged. The same criteria was used for sample colony selection as in the aerial spray test.

Population estimates

In both the aerial and mist-blower study areas, the numbers of larvae in each sawfly colony were es-



estimated to the nearest 10, or counted when less than about 40 were present. This was done to minimize larval disturbance. Pre-spray larval estimates were made the day before spraying. The post-spray estimates were made 24 hr after spraying with a second post-spray larval estimate made 48 hr after spraying in the portions of the mist-blower study area where some larvae had survived.

Frequently, sawfly larvae drop from a tree when disturbed. Drop-cloths were placed to confirm that these larvae were killed rather than lost from knock-down and immigration. The drop-cloths (3 ft x 3 ft) were placed on the ground under one randomly selected sawfly colony in each row of ten blocks in the aerially sprayed area. In the mist-blower sprayed blocks, drop-cloths were placed under 4 tagged trees in each block.

## RESULTS

The sawfly population was reduced 100% in the aerial application area, and an average of 96% (range 84% to 100%) in the mist-blower application blocks (Table 1 and Appendix Tables A and C). In the check (unsprayed) areas the sawfly populations increased, except a slight decrease occurred in mist-blower check Block I (Table 1 and Appendix Tables B and D).

Table 1.--Summary of Pre- and Post Larval Estimates in Aerial and Mist-blower Applications of Malathion Tested on Redheaded Pine Sawfly in 1970.

Treatment	No. Living Larvae/100 Test Trees		Present Reduction
	Pre-Spray	Post-Spray <sup>a/</sup>	
<hr/>			
Aerial			
Sprayed Area	4100	0	100
Unsprayed Area	4494	4949 <sup>b/</sup>	0
Mist-blower			
Sprayed Block			
I	1070	0	100
II	1275	206	84
III	1220	60	95
IV	1220	0	100
V	1290	0	100
Unsprayed Block			
I	1545	1485 <sup>b/</sup>	4
II	964	1164 <sup>b/</sup>	0
III	717	920 <sup>b/</sup>	0
IV	1029	1400 <sup>b/</sup>	0
V	1144	1410 <sup>b/</sup>	0

<sup>a/</sup> Larval estimates were made 24 hours after spraying except 18 hours after spraying in mist-blower spray Blocks II, III and IV.

<sup>b/</sup> See the discussion section for an explanation of the population changes in the unsprayed area and blocks.

## DISCUSSION

Malathion applied either by aircraft or mist-blower is effective against the redheaded pine sawfly. The 100% population reduction by the aerial application suggests that dosages less than 10 fl oz per acre might be effective.

The dead larvae on the drop-cloths under the sprayed trees confirmed larval mortality (Appendix Tables A and C).

Some larvae survived the mist-blower treatment. In Block II, four trees were sheltered by hardwood brush located between the mist-blower and the sawflies. In the same block, the spray was observed to miss one colony as the nozzle passed over the top of that corner tree.

Poor spray coverage was also indicated on four trees in the furthest row of Block III. Possibly some screening of spray was provided by trees in front of the sample trees.

The eight larvae in Block V alive after 24 hr were survivors of a large colony of 130 larvae. However, they were dead in the 48 hr post-spray estimates.

The population increases in the unsprayed areas are suspected to be the result of larval migration from defoliated non-sample trees to nearby sample trees; joining with the sample colony. An overlooked second colony on the sample tree may also have joined with the sample colony. In addition, part of this increase may be attributed to the fact that the larger colonies (over about 40 larvae) were estimated rather than counted.

Natural mortality was low in the study areas. A few dead larvae were observed on one sample tree in the unsprayed area near Cadillac. However, the small amounts of mortality that may have occurred during the three days of the test could not be detected from our population estimates.

On the basis of these tests we recommend that both methods of application with the dosage rates tested be registered for suppression of the redheaded pine sawfly.

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Table A.--Pre- and Post-spray Larval Population Estimates in Aerial Application Study Area Treated with Malathion 95% LV at 10 fl oz per Acre on the Cadillac Ranger District, Manistee National Forest, 1970.

Colony No.	Live Larvae Pre-Spray	Live Larvae Post-Spray	Dead <sup>a</sup> Larvae Cloth	Colony No.	Live Larvae Pre-Spray	Live Larvae Post-Spray	Dead <sup>a</sup> Larvae Cloth
1	40	0	---	51	18	0	---
2	35	0	41	52	24	0	---
3	120	0	---	53	50	0	---
4	50	0	---	54	20	0	---
5	32	0	---	55	30	0	33
6	60	0	---	56	23	0	---
7	11	0	---	57	50	0	---
8	110	0	---	58	20	0	---
9	50	0	---	59	50	0	---
10	19	0	---	60	30	0	---
11	70	0	---	61	17	0	---
12	60	0	70	62	50	0	---
13	40	0	---	63	40	0	---
14	30	0	---	64	70	0	---
15	70	0	---	65	70	0	---
16	90	0	---	66	40	0	---
17	24	0	---	67	40	0	---
18	20	0	---	68	50	0	---
19	30	0	---	69	25	0	---
20	30	0	---	70	70	0	80
21	40	0	---	71	30	0	---
22	70	0	107	72	30	0	---
23	21	0	---	73	80	0	---
24	40	0	---	74	50	0	---
25	40	0	---	75	21	0	---
26	20	0	---	76	40	0	36
27	40	0	---	77	60	0	---
28	40	0	---	78	30	0	---
29	20	0	---	79	16	0	---
30	30	0	---	80	26	0	---
31	16	0	---	81	50	0	---
32	30	0	---	82	24	0	---
33	40	0	35	83	50	0	---
34	70	0	---	84	60	0	---
35	30	0	---	85	50	0	---
36	30	0	---	86	21	0	---
37	80	0	---	87	50	0	---
38	50	0	---	88	30	0	---
39	40	0	---	89	50	0	---
40	22	0	---	90	30	0	---
41	23	0	---	91	19	0	---
42	40	0	---	92	50	0	---
43	50	0	---	93	50	0	80
44	17	0	---	94	22	0	42
45	13	0	---	95	80	0	---
46	25	0	---	96	50	0	---
47	40	0	---	97	21	0	---
48	40	0	59	98	60	0	---
49	80	0	---	99	25	0	---
50	50	0	---	100	b		---
Total					4100	0	

<sup>a</sup> Dead larvae on the tree and drop-cloth were counted for a selected 10 colonies.

<sup>b</sup> Plot lost.



Table B.--Estimated Number of Sawfly Larvae in  
Marked Colonies on the Unsprayed Area  
at Cadillac Ranger District, Manistee  
National Forest, 1970.

Colony No.	Pre- Spray	Post- Spray	Colony No.	Pre- Spray	Post- Spray
1	80	91	51	40	36
2	50	86	52	30	40
3	40	115	53	60	57
4	50	35	54	50	50
5	27	30	55	63	70
6	50	80	56	24	25
7	40	44	57	34	45
8	49	50	58	40	40
9	55	59	59	80	64
10	50	80	60	40	47
11	55	59	61	15	16
12	28	30	62	10	0
13	120	130	63	60	70
14	39	45	64	6	5
15	47	40	65	21	21
16	70	80	66	27	23
17	60	76	67	23	25
18	47	62	68	a	---
19	19	30	69	40	33
20	33	35	70	60	60
21	70	91	71	50	50
22	40	50	72	40	45
23	50	50	73	28	24
24	90	94	74	a	---
25	60	74	75	70	70
26	17	0	76	7	6
27	50	53	77	50	78
28	60	70	78	60	63
29	26	25	79	14	16
30	40	52	80	60	63
31	60	60	81	23	30
32	70	73	82	50	50
33	130	150	83	38	33
34	40	50	84	70	75
35	11	15	85	37	39
36	2	1	86	7	30
37	13	6	87	34	37
38	47	44	88	60	70
39	28	18	89	42	54
40	70	90	90	50	57
41	60	66	91	16	18
42	50	50	92	29	27
43	80	78	93	52	42
44	21	11	94	70	90
45	90	70	95	50	60
46	29	34	96	70	60
47	21	27	97	17	16
48	140	120	98	40	70
49	23	20	99	50	60
50	60	63	100	30	36
			Total	4494	4949

a Plots lost.

Table C.--Pre- and Post-spray Larval Population  
Estimates in the Mist-blower Study Area  
Treated with 1/2 lb Malathion in 2 gal  
Water on the Bessemer Ranger District,  
Ottawa National Forest, 1970.

Block No.	Colony No.	Live Larvae			Dead <sup>a</sup> Larvae Cloth	Block No.	Colony No.	Live Larvae			Dead <sup>a</sup> Larvae Cloth
		Pre- Spray	Post-spray 24 hr. 48 hr.					Pre- Spray	Post-spray 24 hr. 48 hr.		
I	1	60	0	-	---	IV	1	60	0	-	--
	2	20	0	-	---		2	160	0	-	--
	3	90	0	-	---		3	100	0	-	--
	4	80	0	-	---		4	50	0	-	--
	5	150	0	-	340		5	120	0	-	--
	6	40	0	-	---		6	50	0	-	--
	7	50	0	-	30		7	50	0	-	--
	8	60	0	-	---		8	50	0	-	--
	9	60	0	-	---		9	90	0	-	90
	10	80	0	-	104		10	40	0	-	--
	11	20	0	-	---		11	30	0	-	37
	12	50	0	-	50		12	60	0	-	--
	13	40	0	-	---		13	30	0	-	--
	14	30	0	-	---		14	70	0	-	67
	15	50	0	-	---		15	40	0	-	--
	16	50	0	-	---		16	60	0	-	--
	17	20	0	-	---		17	50	0	-	--
	18	40	0	-	---		18	40	0	-	44
	19	30	0	-	---		19	50	0	-	--
	20	50	0	-	---		20	20	0	-	--
Total		1070	0	-		Total		1220	0	-	
II	1	90	0	---	86	V	1	20	0	-	--
	2	140	140	80	--		2	130	0	-	--
	3	60	0	---	--		3	110	0	-	--
	4	20	10	10	--		4	50	0	-	46
	5	60	0	---	64		5	80	0	-	--
	6	5	0	---	--		6	80	0	-	--
	7	60	0	---	--		7	40	0	-	--
	8	50	0	---	49		8	130	8	0 <sup>b</sup>	--
	9	50	0	---	--		9	50	0	-	--
	10	20	0	---	--		10	70	0	-	--
	11	60	0	---	--		11	50	0	-	--
	12	40	0	---	--		12	30	0	-	--
	13	60	70	70	--		13	80	0	-	--
	14	90	0	---	82		14	100	0	-	85
	15	160	0	---	--		15	20	0	-	--
	16	50	0	---	--		16	50	0	-	--
	17	70	0	---	--		17	50	0	-	21
	18	20	0	---	--		18	20	0	-	--
	19	100	100	100	--		19	40	0	-	51
	20	70	0	---	--		20	90	0	-	--
Total		1275	320	260		Total		1290	8	0	
III	1	80	7	0	--						
	2	40	30	30	--						
	3	70	0	--	--						
	4	70	0	--	17						
	5	50	0	--	---						
	6	50	0	--	---						
	7	70	0	--	31						
	8	70	0	--	---						
	9	30	0	--	---						
	10	50	0	--	51						
	11	90	0	--	---						
	12	50	0	--	---						
	13	100	0	--	98						
	14	20	4	0	--						
	15	40	40	30	--						
	16	70	0	--	---						
	17	50	0	--	---						
	18	60	0	--	---						
	19	40	0	--	---						
	20	120	0	--	---						
Total		1220	81	60							

<sup>a</sup> Dead larvae on the tree and drop-cloth were counted for a selected 20 colonies.

<sup>b</sup> Larvae had ceased feeding and were regurgitating--assumed dying.

Table D.--Pre- and Post-spray Larval Population Estimates in Marked Colonies on the Unsprayed Mist-blower Study Area on the Bessemer Ranger District, Ottawa National Forest, 1970.

Block No.	Colony No.	Pre-Spray	Post-Spray	Block No.	Colony No.	Pre-Spray	Post-Spray
I	1	120	110	IV	1	50	50
	2	90	90		2	35	40
	3	60	90		3	30	40
	4	100	100		4	40	80
	5	105	100		5	22	80
	6	50	60		6	80	80
	7	40	40		7	40	60
	8	50	40		8	50	80
	9	160	160		9	40	45
	10	40	40		10	50	60
	11	70	70		11	70	80
	12	100	90		12	60	60
	13	120	110		13	40	40
	14	30	40		14	70	70
	15	25	20		15	65	80
	16	60	50		16	40	50
	17	55	35		17	60	100
	18	90	90		18	22	25
	19	95	80		19	55	100
	20	85	70		20	110	180
	Total	1545	1485		Total	1029	1400
II	1	80	170	V	1	40	50
	2	50	60		2	60	60
	3	70	60		3	50	70
	4	25	30		4	30	30
	5	30	70		5	50	70
	6	100	50		6	60	60
	7	9	9		7	50	50
	8	25	35		8	50	70
	9	80	100		9	60	110
	10	70	60		10	120	200
	11	70	70		11	30	30
	12	30	50		12	30	30
	13	70	60		13	40	50
	14	30	30		14	160	170
	15	25	40		15	20	60
	16	40	70		16	70	80
	17	40	60		17	100	100
	18	40	50		18	40	40
	19	30	30		19	14	10
	20	50	60		20	70	70
	Total	964	1164		Total	1144	1410
III	1	45	50				
	2	30	50				
	3	35	70				
	4	70	170				
	5	19	10				
	6	20	20				
	7	50	50				
	8	60	50				
	9	18	20				
	10	20	20				
	11	20	20				
	12	60	70				
	13	40	60				
	14	60	60				
	15	30	30				
	16	35	40				
	17	25	30				
	18	25	30				
	19	40	40				
	20	15	30				
	Total	717	920				